Claims

We claim:

1. A method of determining an optimum configuration for a system having a plurality of devices, comprising:

sampling a combinatorial space formed by the plurality of devices to obtain a sample configuration;

generating an optimization metric based on at least one operating characteristic of said plurality of devices in the sample configuration;

comparing the optimization metric with a stored optimization metric corresponding to a previous sample configuration; and

selecting one of the sample configuration and the previous sample configuration as the optimum configuration based on the comparing step.

2. The method of claim 1, wherein the plurality of devices are a plurality of elements each comprising at least one unit.

3. The method of claim 2, wherein said at least one unit is selected from a group consisting of a primary unit and a redundant unit.

4. The method of claim 2, wherein the sample configuration incorporates at least one module integrating at least two elements, and wherein the sampling step comprises:

choosing a number of modules in the sample configuration;

assigning at least one element into each module; and

distributing any remainder of said plurality of elements among the modules to complete the sample configuration.

5. The method of claim 4, further comprising identifying elements that cannot be integrated into one module.

6. The method of claim 1, wherein the optimization metric calculated by the generation step is a cost optimization metric based on a total cost of the plurality of devices.

7. The method of claim 6, wherein the cost optimization metric also incorporates at least one of a modularization benefit, a compression cost overhead reflecting an overhead cost in integrating at least two elements into a module, and a cardinality cost reflecting an overhead cost associated with an individual module.

8. The method of claim 1, wherein the optimization metric calculated by the generating step is a reliability optimization metric based on a total reliability of the plurality of devices.

9. The method of claim 8, wherein the reliability optimization metric is calculated based on a total downtime of the plurality of devices.

10. The method of claim 9, wherein the reliability optimization metric also incorporates adjustments to the total downtime based on modularization.

11. The method of claim 1, wherein the optimization metric calculated by the generating step is a total optimization metric based on a total cost and a total reliability of the plurality of devices.

12. The method of claim 11, further comprising obtaining a relative weighting of a cost constraint and a reliability constraint, wherein the optimization metric is calculated based on the relative weighting.

13. The method of claim 1, wherein the optimization metric is calculated based on at least one weighted constraint.

14. The method of claim 1, further comprising storing the optimization metric and the sample configuration if the optimization metric is less than the stored optimization metric.

15. The method of claim 1, further comprising repeating the sampling, generating and comparing steps for a maximum number of iterations, and conducting the selecting step after the maximum number of iterations.

16. The method of claim 1, further comprising repeating the sampling, generating and comparing steps until the optimization metric converges, and conducting the selecting step after the optimization metric converges.

17. A method of determine an optimum configuration for a system having a plurality of devices, comprising:

sampling a combinatorial space formed by the plurality of devices to obtain a sample configuration;

generating a total optimization metric based on a total cost and a total reliability of the plurality of devices in the sample configuration, wherein the total optimization metric is calculated based on a relative weighting of a cost constraint and a reliability constraint;

comparing the optimization metric with a stored optimization metric corresponding to a previous sample configuration;

erasing the stored optimization metric and storing the optimization metric and the sample configuration if the optimization metric is less than the stored optimization metric;

repeating the sampling, generating and comparing steps until at least one of an optimization metric convergence and a maximum number of iterations occurs; and

selecting one of the sample configuration and the previous sample configuration as the optimum configuration based on the comparing step.

18. The method of claim 17, wherein the plurality of devices are a plurality of elements each comprising at least one unit selected from a group consisting of a primary unit and a redundant unit.

19. The method of claim 17, wherein the sample configuration incorporates at least one module integrating at least two elements, and wherein the sampling step comprises:

choosing a number of modules in the sample configuration;

identifying elements that cannot be integrated into one module;

assigning at least one element into each module; and

distributing any remainder of said plurality of elements among the modules to complete the sample configuration.

20. The method of claim 17, wherein the total optimization metric calculated by the generation step includes:

a cost optimization metric based on a total cost of the plurality of devices and at least one of a modularization benefit, a compression cost overhead reflecting an overhead cost in integrating at least two elements into a module, and a cardinality cost reflecting an overhead cost associated with an individual module; and

a reliability optimization metric based on a total downtime of the plurality of devices and adjustments to the total downtime based on modularization.